The SAHARAN toolbox: A comprehensive assessment of school-age children’s growth, cognitive and physical function

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Overview

Introduction: Life course, SHINE trial

Methods: SAHARAN toolbox

Results: Growth, physical & cognitive function

Future plans: IMMANA metrics
The Life Course Approach: 250 million children ‘failing to thrive’

- **Brain / body Function**
- **Generational effects**
- **SAHARAN toolbox**
- **SHINE WASH & IYCF intervention**
- **Healthy**
- **Stunted**
- **Protective factors**
- **Risk factors**

**Child Health for All, 6th Ed**, Saloonje, Piper et al.

Height and body-mass index trajectories of school-aged children and adolescents from 1985 to 2019 in 200 countries and territories: a pooled analysis of 2181 population-based studies with 65 million participants, NCD Risk Factor Collaboration, Lancet Nov 2020
SHINE: independent and combined effects of IYCF and WASH in Zimbabwe

15% children born to HIV-positive mothers “HIV-exposed uninfected” (CHEU)

Preliminary data: please do not share

4 to 6+ visits / day [620 visits]

1000 HIV unexposed (CHUU) = 250 in each arm

→ detect a difference of 0.2 SD for the intervention

300 CHEU

→ Detect a difference of 0.2 SD c.f. CHUU (0.35 SD for intervention on CHEU)
3. SAHARAN Development: The school-aged health, activity, resilience, anthropometry and neurocognitive assessment toolbox

- Executive Function
- Academic WRAT
- Socio-emotional SDQ
- Functional screening WG
- Cognitive function K-ABC2
- Quality of Growth
  - BIA (Lean mass index)
  - Skinfolds, Knee-heel length
  - Anthropometry
- Physical function
  - Fine motor
    - Finger tap
  - Grip strength, broad jump
  - Bleep test, Hb, BP, HR

Caregiver Questionnaire
- Demographics
- SES
- Child adversity
- CPRS (nurture)
- EPDS (maternal depression)
- Food insecurity (HFIAS, HDDS & H-FOOD)
- Water insecurity (H-WISE, H-WATER, access)
- MICS Child discipline
- Gender norms & social support
- HIV counselling & testing

Piper et al. Characterising school-age health and function in rural Zimbabwe using the SAHARAN toolbox, (PloS One under review)
Body composition: Bioimpedance analysis (BIA)

321 girls, 298 boys
Age 7 years,
160 CHEU

Quality of Growth
BIA (Lean mass index)
Skinfolds, Knee-heel length
Anthropometry
4.3 Cognitive function

Cognitive function
KABC-II

- Executive function
- Academic Literacy
- Numeracy
- Socio-emotional
- SDQ
- Functional screening
- WG
- Fine motor
- Finger tapping

Preliminary data: please do not share
Piper et al. Adaptation of the Kaufman Assessment Battery for Children—2nd edition (KABC-II) to assess school-age neurodevelopment in rural Zimbabwe (manuscript in preparation)
Aim 1: Develop the SAHARAN toolbox which holistically measures child growth & function

Aim 2: Develop the COG-SAHARAN & GROW-SAHARAN metrics

Aim 3: Operationalise metrics by analysing response to nutrition interventions in SHINE children

SAHARAN measurement

SAHARAN TOOLBOX (3 hours)

Factor analysis & agreement analysis

METRICS

COG-SAHARAN
measures school-age cognitive function

GROW-SAHARAN
measures school-age growth, body composition & physical function

SUB-SAHARAN
explore potential value of combined cognition & growth metric

Operation: Test feasibility, acceptability & metric performance

1000 school-aged children in rural Zimbabwe

Control
Standard of care

WASH
Water and sanitation Hygiene

IYCF
Infant and Young Child Feeding

WASH + IYCF

UPTAKE

Toolbox to facilitate adoption in other contexts

Promote uptake of open-source metrics

Webinars, workshops, short film on school-age outcomes & metrics
ENN

Accelerate progress towards SDGs

1. **Preliminary data: please do not share**
2. Improve child growth & cognitive development
3. Improve child physical development & reduce NCD risk
4. Improved school performance
5. Improve adult wages & reduce inequality
6. Intergenerational improvements in growth

Impact:
- **NGOs, Ministry of Health, Food and Nutrition Council, UNICEF, WHO**
- **Impacts held 5-15 years**
- **Adopt into policy and programming**

**Metrics’ uptake**
- Longer term
- 5 years
- Research teams, ANH, Ag2Nut, UNICEF, WFP, Gates Foundation, relief agencies, NGO’s, Ministries, policy makers, ENN

Grant objectives

- Develop **SAHARAN toolbox** to holistically measure school-age growth, physical and cognitive function
- Develop **COG-SAHRAN metric** for school-age cognition
- Develop **GROW-Saharan metric** for school-age health
- Explore potential of combined **SUB-SAHRAN metric**
- **Operationalise** metrics within the SHINE cohort to see impact of early-life interventions

Conduct high quality proof of concept trial

- **Grant Outputs**
- 2 years

1. **SAHARAN TOOLBOX: Paradigm shift to include multiple dimensions of school-age growth & function**
2. **COG-SAHARAN, GROW-SAHARAN METRICS**
3. **Apply among 1000 households in rural Zimbabwe:**
   - **Unique databank** of school-aged growth, NCD-risk, physical & cognitive function
   - **Novel factor and reliability analysis** suggesting key exposures that determine child cognitive function & health
4. **Uptake, transferability & engagement:** learning labs, webinars, commentaries, open-source toolbox, online film

Research teams in partnership with Village Health Workers
Summary

• SAHARAN Toolbox
• Body composition, growth and physical function:
  • Strong link of function to growth
    – LMI, birthweight, LAZ at 18 months for physical function
    – HAZ for physical & cognitive function
• Future
• Field-ready Metrics
• Impact of SHINE nutrition & WASH interventions
• Early-life associations e.g. HIV-exposure
• Contemporary associations & adversity
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i) Broad jump

Physical function
Grip strength, broad jump
Beep test, Hb, BP, HR

ii) Grip strength


Skinfold thickness: measures fat mass

Percentile curves for skinfold thickness in 7- to 14-year-old children and adolescents from Jena, Germany


Preliminary data: please do not share
Sigt effects: Schooling, child socioemotional score